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NATURAL HISTORY IN THE GRADES

OTIS W. CALDWELL
The University of Chicago

VI. SIXTH GRADE

Pupils of the sixth grade usually are at a stage of development which makes possible and desirable a more prolonged and more intensive study of a few topics as compared with the rather large number that have been outlined in the work of the first five grades. The garden work that was begun during the spring of the preceding school year is used as the basis for part of the sixth-grade work; the other part deals with hygiene and elementary human physiology.

In the preceding spring this grade planted numerous vegetables and flowering plants, some of which have been cared for through the summer. At the opening of school in the autumn the seeds of these plants are available for collection and use in a study of some of the special topics to be considered by the class. In case of plants that mature early and would lose all their seeds during the summer, the entire plants are collected and kept in order that they may be available for school use. The collection of seeds from plants planted by the pupil is in itself a valuable piece of work. Pupils have been studying how plants grow from seeds, how plants must be cared for in order that they may thrive, how pollination is effected, and now the collection and a brief study of seeds completes these general facts of the plant life-cycle. Collection of seeds should be made, carefully labeled and given to the new fifth grade. This supply cannot be

entirely depended upon for all needed seeds for the next year's work of the fifth grade, but will be of some value. It is of great educational value, however, to have the sixth and fifth grades co-operate in this way.

The difference in form, size, color, and number of seeds produced by different kinds of well-known plants is always interesting. Various seed-bearing structures (fruits) are well shown by a good collection of garden plants. Comparison may be made between such fruits as those of the radish, cress, shepherd's purse, sunflower, poppy, geranium, pansy, rose, abutilon, evening primrose, wild lettuce, milkweed, and catalpa. Class or individual trips to vacant lots for the purpose of collecting seeds and fruits will result in augmenting the collection and the interest therein. These fruits should be mounted on large cardboard, being grouped according to their source, to their form, or to the persons collecting them.

How many seeds does a plant produce is the next problem that is presented. Here is begun a definite study of the average number of seeds produced by each of a few kinds of plants, the forms selected for this work being those easily handled as the sunflower, radish, evening primrose, jimson-weed, or catalpa. Careful counts are made of the seeds actually found within a number of fruits (pods or heads), and then the average number of those counted is calculated. In one case of seeds which were very small, one class found how many teaspoons of seeds they had, then by arranging in a row on a sheet of paper one teaspoonful they made their estimate. Since, in most cases, the number varies and since there is danger of error the number of fruits from which seeds are counted should be rather large. It is a good plan to have each member of the grade count seeds from at least one fruit of each kind of plant, then have all calculate the average number. The next step is to determine the average number of fruits borne upon one plant. Sometimes as in the case of the catalpa or rose the material available makes this calculation possible for but one plant. By use of the number of seeds in a fruit and the number of fruits on a plant the total seed-production of one plant is approximated. This total

number produced from a single plant, presents to children in a striking way the large possibilities for reproduction that are constantly occurring.

The next problem is to determine the area of ground that would be required if all seeds produced should grow next year and produce plants similar to the one that produced these seeds. This is estimated by measuring the area of ground covered by one adult plant of the kind under consideration. As before, several are measured in order that a fairly dependable average may be made. Pupils show much difference of opinion regarding what should be considered as the area covered by one plant, and it has been agreed that the space shaded shall be counted as the space belonging to a plant. This is so considered regardless of the fact that other plants may grow in this shaded area. It is best to estimate a length and breadth of the area covered and thus secure an approximation of the number of square feet, since more complicated arithmetical processes would be entangling. In order to make certain that the significance of the rate of possible increase of space covered is seen, this calculation should be made with more than one plant, or with a plant and an animal (robin, fish, toad), an additional calculation that is helpful is had by calculating the amount of space occupied or the number of offspring produced by the third or fifth generation. It is only by carefully calculated concrete cases that any real significance comes from this work.

The next problem is found in the pupil's statements already frequently made, such as: "It does not happen so"; "Not so many new plants really are produced"; "How does it come that the earth isn't covered by this plant?" "Why do not more plants grow?" "What becomes of all the seeds that do not grow?" "Why do not more individuals of this kind of plant grow?" The fact that not all grow is at once seen by pupils when they have finished the last problem, and they almost immediately begin to suggest some of the reasons that occur to them in explanation of this fact. Observation, study, and consultation produce many aspects of the situation some of which are: there is not space (room) for all to grow and some are stifled after they have

begun to grow; some places are too dry for these plants to grow and some too wet; not all can secure adequate light, air, and soil; many seeds fall upon unfavorable places and do not germinate; many seeds decay; many seeds are eaten by birds (refer to fifth-grade work upon the food of birds); many plants are devoured by animals, or killed by plant or animal diseases; but a few survive as compared with all that are possible. These are the ones that grow where they can have space, light, air, water, proper temperature, and that are not destroyed by crowding from other plants or by attacks from herbivorous animals or parasites.

At this point reference should be made to seed distribution which was studied in the fifth grade. Some additional study of structures that serve to carry seeds proves valuable in the new light of these studies, there being apparent now more of the real meaning of having a seed germinate in a relatively unoccupied and favorable place. Also it will prove helpful to bring into the room a square foot of vacant lot soil taken four inches deep, and keep it in a box under favorable conditions so that all seeds in it may grow. Once a week count and remove all seedlings and finally determine how many seeds began to grow in this area.

It is not wise to attempt to carry a study of the struggle for existence into further details in the grades. The concrete data, with some of the relatively evident interpretations, are all that should be sought. This, it is hoped, will furnish a concrete basis upon which some years later a more searching study will be made. It is hoped that an interest will be developed which will cause these pupils always to be observant of the abundant illustrations that relate to this problem.

The reader will find that the fulness of the preceding outline suggests the use of more time than will really be needed to accomplish this work. Some classes will require more time than others but six or seven weeks should be ample.

The major part of this year's work is upon hygiene and elementary human physiology. The forthcoming adolescent period, intensified interest in themselves physiologically, socially, and intellectually, an interest in the industrial and social factors

of the environment make this an excellent period for a formal study of this topic. In preceding grades there has been constant admonition by the teacher upon detailed matters pertaining to schoolroom and personal cleanliness, health, and proper positions, exercise, and habits. Indeed, development of habits in proper hygiene must begin as early as does education and continue until their efficiency no longer depends upon constant external stimulus. But at this age it is thought best to give attention to development of an understanding of some of the reasons for proper practices. This should intellectualize some of the previous admonitions, thus giving basis for more faithful performance and extension of habits, and should prepare an intelligent foundation for proper response to the many situations incident to youth.

The preceding elementary-science work leads logically to this work in hygiene. In each grade some study has been made of the life of plants and animals. In schoolroom and garden experiments, in field observations, and in reading there has been a constant study of how plants and animals live; their food, their air and water supply, their relation to one another, the development of young into adults, the diseases that may attack them, pollination, seed-formation, and the new plant, all give in study of both structure and function a background which is believed to furnish the most logical approach to an elementary understanding of the pupil's own body and its needs.

Obviously the amount of experimentation that was used with plants and animals cannot now be made, though much valuable experimentation is possible and necessary. Pupils must look upon their bodily actions from the point of view of experiment; sometimes they must really perform experiments; and often they must interpret their own function in terms of what they know of plants and animals. Good topics for introductory experiments are circulation, respiration, and muscular activity. All know something of each of these functions and each pupil can be interested at once in comparing his condition with that of his fellows. For example, two boys were at the opening of this work called before the class and their pulses taken (a process with which all are

familiar). These boys were then told to run around the block in which the school building stands and return immediately to the room. The pulses were again taken. An explanation of the difference in readings was called for, and this furnished a basis for beginning work upon the circulatory system. The same sort of an experiment is good for introducing respiration and for relating it to circulation. The nature of some of the leading bones and their relation to one another in muscular work may be introduced by a study of several gymnastic feats with which all children are familiar.

Organs and the processes that are performed by means of them are studied not anatomically or from the point of view of physics and chemistry, but from the point of view of their proper efficient working. How the parts of a healthy human animal work when highest efficiency is secured must be made clear. Then to secure constantly this high efficiency attention must be given to things that interfere with it. Improper posture is not wrong primarily because it may lead to crooked bones, though that is bad, but primarily because crooked bones reduce efficiency. Good heart-action, respiration, sight, hearing, digestion, etc., enable us to do more bodily and intellectual work. Abuse of the body resulting in reduction of vitality simply involves disposing of part of our native capital by means of which we might accomplish things. Ventilation, cleanliness, proper bodily temperature, proper sleep, etc., are the conditions under which bodily parts may work properly.

Infection and disease also have a place in this course. By reference again to diseases of plants and animals and to what is already known of human disease a fairly clear notion of the nature of bacterial disease may be given. Some simple demonstrations in growth of bacteria in test tubes, this being elaborated by careful and concrete discussion, proves helpful. The distribution of bacteria, especially disease-producing bacteria, means of infection in case of some of the common diseases, proper water, milk, and food supply are topics for demonstration and discussion.

The influence of alcohol and narcotics is one of the topics that

must be considered in connection with highest efficiency of the human body. This topic, as some others, must be kept free from foolish emotionalism and kept upon the basis of individual and social efficiency. That it is an ethical question is obvious; also bodily efficiency is an ethical question. The best reaction from instruction upon dangers from alcohol and narcotics will doubtless come from a clear and abiding understanding of the relation they bear to the normal work of the human body.

This grade should study the city regulations regarding public health—water and milk supply, garbage and sewage disposal, street-cleaning, the city health department. The school and home garden and the general movement relative to beautifying home grounds should be emphasized in its bearing upon public health.

Such a course in hygiene as here outlined is greatly benefited if a simple, direct, readable, and appropriate book can be used as a pupil's reader. A series of books for different grades has been prepared by Dr. Luther Halsey Gulick. Of this series one well suited to the sixth grade is *The Body and Its Defenses.*